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United States Patent [19]**Suzuki et al.**[11] **Patent Number:** **5,600,462**[45] **Date of Patent:** **Feb. 4, 1997**[54] **OPTICAL FILM AND LIQUID CRYSTAL
DISPLAY DEVICE USING THE FILM**[75] **Inventors:** Masaru Suzuki, Yamato; Fumihisa
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[51] **Int. Cl.⁶** G02F 1/1343[52] **U.S. Cl.** 349/112; 349/62[58] **Field of Search** 359/69, 48, 49,
359/50, 42, 599; 362/31, 330, 333; 385/146,
901[56] **References Cited****U.S. PATENT DOCUMENTS**

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James E. Murray[57] **ABSTRACT**

The luminance within the viewing angle of an LCD device is increased by using an optical film of transparent material. The film has a first surface having a wave structure including a plurality of isosceles triangle prisms arranged side-by-side, and a second surface having an optically rough structure for performing diffuse transmission. The film may also have a first surface having a structure including a plurality of quadrangular prisms arranged side-by-side, and a second surface having an optically rough structure for performing diffuse transmission.

7 Claims, 8 Drawing Sheets